

The diagram is prepared primarily for barometric pressure 30 inches. Results will be sufficiently accurate for most practical purposes whenever the barometric pressure is not less than 27 inches. The variation of dewpoint and relative humidity with barometric pressure is illustrated for the case of dry-bulb reading 60° and wet-bulb 54° in the subjoined table.

Most evaporation formulas, including that of the

author, involve the maximum vapor pressure at the temperature of the evaporation surface, and the actual vapor pressure in the air, as factors. The diagram is especially adapted to the determination of these quantities, either from observational data where the dry-and-wet-bulb readings are given, or from published data where either the air temperature and relative humidity, or air temperature and dewpoint, are given.

A PSYCHROMETRIC CHART FOR DETERMINING THE DEWPOINT AND RELATIVE HUMIDITY.

By R. B. SMITH, C. E.

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Psychrometric observations are usually reduced by means of tables computed from some formula for the pressure of aqueous vapor in the air and from the known values of this pressure for saturated air. It is entirely feasible to perform this reduction graphically without the use of tables by means of a chart constructed according to the following principles:

(1) The addition of two quantities which can be represented with sufficient accuracy on a suitable scale can be effected graphically by laying a straight edge between two scales on which the two quantities are plotted and reading the value where the straight edge crosses a third scale, midway between the other two, in units one half as large as those used in plotting the quantities to be added, provided all three scales have their zero values on a straight line. This is clear from Fig. 1, in which a and b represent the quantities to be added and $a' + b'$ represents their half sum for all values of a and b .

(2) The subtraction of one quantity from another can be effected graphically by the same operation, provided the quantity to be subtracted is plotted in a direction opposite to that of the other two scales, as shown by Fig. 2, where evidently $a' - b'$ represents half the difference between a and b for all values of a and b .

(3) Multiplication or division can be performed graphically by substituting, for the numbers representing the quantities to be added or subtracted, their logarithms.

Fig. 3 illustrates the application of the foregoing principles to the graphical reduction of psychrometric observations by a solution of the formula

$$e - e' = .00066 B (t - t') (1 + .00115 t').$$

The factor B is incorporated in the solution as follows:

If a , Fig. 3, represents a value of $.00066 \times 760 (t - t')$, b the value 760 and b' the value of B , then $a' = B (t - t') = 760B (t - t') / 760$, since $a' : b :: a : b$, or $a' = ab' / b$.

The relative humidity is determined by measuring directly the difference between the values of $\log e'$, figure 3, corresponding to the temperature of the air and the temperature of saturation (dewpoint) respectively and subtracting this difference from the value of $\log 100$.

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The chart when ready for use in reducing observations is simply lettered with the values of the psychrometric data corresponding to the values on the scales and with notes giving an explanation of the procedure to be followed

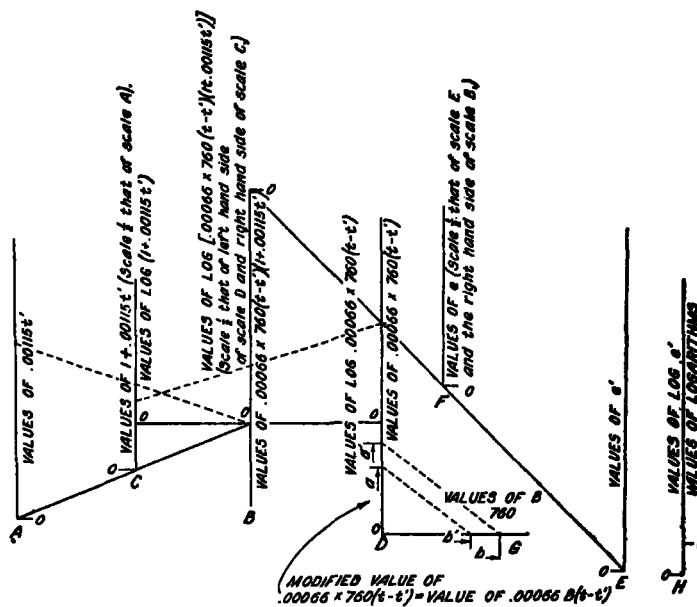
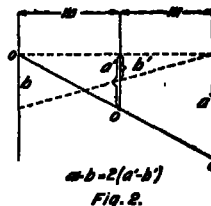
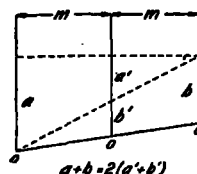


Fig. 3. SCHEME OF GRAPHICAL SOLUTION OF THE FORMULA $C=C'-0.00066 B(t-t')(1+.00115 t')$ EMPLOYED IN CONSTRUCTING PSYCHROMETRIC CHART.

KEY

To Find the Dew Point

(1) Connect the given value of t on scale A, and the value h on the left hand side of scale B, with a straight line, and extend this line to the right hand side of scale C.

(2) Connect the given value of $t - t'$ on the right hand side of scale D, and the value h on scale B, with a straight line, and extend this line to the right hand side of scale E.

(3) Transfer the straight line from scale E, to the right hand side of scale F, and read the value of $t - t'$ on the right hand side of scale F, and the value read on the left hand side of scale G.

(4) Connect the given value of t on scale A, and the value read on the left hand side of scale G, transferred to the right hand side of scale H, with a straight line. The temperature of saturation (dew point) can now be read on scale H where this line crosses it.

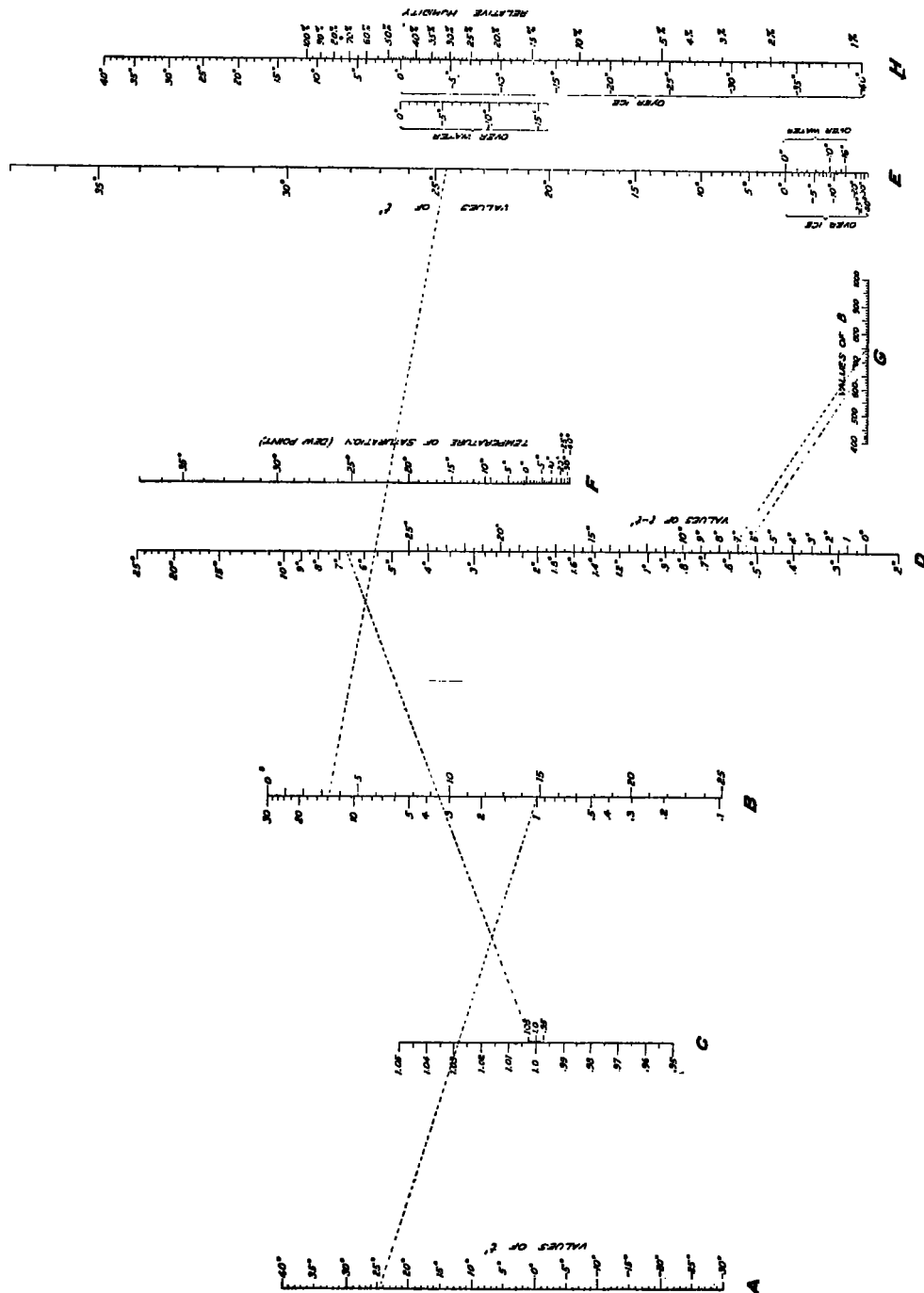
To Find the Relative Humidity

Take the given value of t and the temperature of saturation (dew point) on the left hand side of scale H, and transfer the straight line between these two points (e.g. with a compass) to the right hand side of scale I, where it can now be read on the right hand side of scale I by sliding off the length downward from the value 100%.

NOTE

This chart is based on Ferrel's formula, which is
 $e = e' - .00066 B (t - t') (1 + .0018 t)$, where
 e = the pressure of aqueous vapor in the air,
 e' = the pressure of aqueous vapor at the temperature t' ,
 t = the temperature of the air,
 t' = the temperature of saturation,
 B = the Barometric pressure.
 The values of e used here were taken from the Smithsonian Meteorological Tables, 1910 Ed.
 The temperature of saturation (dew point) is the temperature at which the air is saturated with the pressure of aqueous vapor in the air.
 The relative humidity may be expressed as the ratio of the actual pressure of aqueous vapor in the air to the pressure of aqueous vapor in saturated air at the same temperature.

Revised Bureau of U.S. Chief Signal Officer, 1908.



PSYCHROMETRIC CHART FOR DETERMINING THE DEW POINT AND RELATIVE HUMIDITY

PSYCHROMETER CHART (MARVIN)

U. S. WEATHER BUREAU

#140/2

AMOUNT OF VAPOR, GALLONS PER 100,000 CU. FT.

